

Fluorescence turn-off and turn-on sensing of Fe(III) and ascorbic acid by carbon dots synthesized from coffee waste

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As the coffee industry grows, the amount of coffee waste discarded each year increases. Most coffee wastes are landfilled or incinerated, and soils are contaminated by caffeine in coffee waste. Herein, coffee waste-derived carbon dots (C-CDs) that emit blue light were synthesized. The synthesized C-CDs were characterized using XPS, XRD, FT-IR, and FE-TEM. In addition, optical properties were investigated by UV-Vis and PL spectroscopy. The synthesized C-CDs were round shape with size of ~3.7 nm and showed graphitic structure. C-CDs show PL dependence on pH and long-term stability but independence on NaCl concentration. The C-CDs showed promising applications as Fe³⁺ sensors in aqueous solutions. The C-CDs exhibited strong turn-off fluorescence when trace Fe³⁺ (0 to 100 μM) was added to the solution. In addition, fluorescence was recovered when ascorbic acid (AA) was added to the C-CDs/Fe³⁺ complex. The fluorescence response showed a good linear relationship, and the limit of detection (LOD) was 4.314 and limit of quantification (LOQ) was 13.074. The C-CDs and C-CDs/Fe³⁺ show very good selectivity for sensing Fe³⁺ and AA, respectively.